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JUNO-TAO Experiment with Large Area High Performance SiPMs

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Taishan Antineutrino Observatory (TAO) is a ton scale liquid scintillator (LS) detector and proposed to precisely measure reactor neutrino energy spectrum with as high as possible energy resolution, which can provide a reference spectrum for Jiangmen Underground Neutrino Observatory (JUNO) and a benchmark to verify the nuclear database. Tao is a satellite experiment of JUNO and will be installed near the reactor core with a distance of ~30 m. The detector uses 2.6 ton gadolinium-doped LS (1 ton fiducial volume) contained in a spherical acrylic vessel. To maximize the photon collection efficiency in the detector, 10 m² SiPM array is proposed to fully cover the acrylic vessel and collect scintillation photons as many as possible. The preferred photon detection efficiency of SiPM should be larger than 50%, in order to achieve the desired energy resolution (1.5%/sqrt(E) photon statistical resolution). Meanwhile, the SiPMs will also be operated at low temperature (-50 degree or lower) to reduce the dark noise. The detector R&D has been started for more than one year, and the JUNO-TAO experiment is expected to be online in 2021. In this talk, an overview of the JUNO-TAO will be reported, then put the emphasis on the requirements of SiPMs, and ongoing R&D work related to SiPM characterizations and electronics readout.

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